Animal Care Management System using Internet of Things and Artificial Intelligence in Zoo

Swathi Madhavan, Kiran S Parakkal, Rahul P M, Roshan John

Abstract: *Zoo is a place where animals are cared and looked after by a team of officials. Moreover it will also provide tourists to have a look at the animals and is made in tourist purpose. It also provides education purposes. Moreover it serves and takes care of many wild animals with the help of many human beings. The work of those human beings is very difficult as they are dealing with wild animals and are hectic to look after them. This is more in the case of zoo administrators as they are dealing with more of the animals in person In this paper we are dealing a way more often with the administrators to pave the way to ease their job by some methodologies. Collaborating Internet of Things (Iot) and Artificial Intelligence (AI), we can introduce a way that will make the zoo administrators work in easy manner. Moreover we can make the zoo expenses low. This paper proposes an intelligent method for zoo administrators.*

Keywords: **Administrator,** *Artificial Intellegence(AI), Cloud Computing, Deep Learning, Internet of Things(Iot), Zoo*

I. INTRODUCTION

Zoo is a place where animals will be stored in fences. The work of zoo administrators is always a difficult job as they need to take care of animals in contact. They need to take care of the animal's health and report them to the higher officials daily. It is cumbersome process as it takes almost the end of the day to report it. Another difficult task is to feed the animals.

According to the association of zoos and aquariums, there are more than 180 million visitors in zoos in USA than NBA, NFL, NHL, and MLB. According to surveys, 93% agreed that families like to visit zoo than any other tourist, 94% agreed that zoo will teach the children regarding the protection of habitat and culture of animals.[1]. But we should consider first the animals and their health before the zoo [2]. Different zoos have different area, thousands or ten thousands of animals with different shape, characteristics, and physical difference. To manage it, we need to be proficient in technological tools and real time control. Integrating information technology and other principles we can formulate the efficient management of animals.

Using the AI technology and Iot, we can formulate some principles to help the zoo administrators and to automate the zoo. It is one of the areas where still advancements technology didn't take place. With the Iot technology large number of animal data and signals can be collected [3-4]. These data can be processed with the help of AI. Although AI technology helps to process many data and signals, many preworks have to be carried out [5].

Lucky Tag smart collar used in pets is used to manage the pets [6]. It can also be used to health monitoring and missing and searching. By observing long trends , the owner can find out the diseases early. . Recently, the Yamato Zoo in Sapporo, Japan, in cooperation with Hokkaido University, began to use artificial intelligence (AI) systems to analyze animal behavior patterns to improve animal support environment and effectively monitor animal health [7].

II. THEORY

The zoo administrator has to take care of every animal very efficiently. In order to them we will develop architecture to provide intelligent management operations. Thereby we can provide the corresponding measures for the control of the zoo. To make this in action and to help the animal administrators to clearly understand the species individually, feed, water volume, and other information, we can use AI deep learning technology and Iot.
We can employ wide variety of ways to make this in action

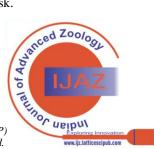### A. Collection of data using animal biomedical signal sensors

We will use a variety of biomedical sensors related to animals to collect biomedical data. Here we can include body temperature sensing, heartbeat sensing and these datas will be then analyzed using AI includes the feed data. These datas can be used to predict the health status of animals.

B. Control of Environmental factors

In this aspect we will use wide variety of environmental sensors such as temperature, humidity sensors, and rainfall sensors to detect the surrounding environmental factors of the animal. By this method, we can control and adjust the humidity and temperature according to the animal need.

C. Automatic feeding control

The most cumbersome work for the animal administrators is to feed the animals. The animal feeding for each and every animal in the zoo is difficult task.

* Correspondence Author
Swathi Madhavan*, Electronics & Communication, NSS College of Engineering, Palakkad, India. Email: swathimadhavan363@gmail.com
Kiran S Parakkal, deElectronics & Communication, NSS College of Engineering, City, Country. Email: kiransparakkal98@gmail.com
Rahul P M, Electronics & Communication, NSS College of Engineering, Palakkad, India. Email: rahulpmcty@gmail.com
Roshan John, Electronics & Communication, NSS College of Engineering, Palakkad, India. Email: roshanjohn457@gmail.com

We can employ a relay system so that if the administrator placed the food in a tunnel by the relay mechanism the administrator can easily feed the animal.

D. Real Time Monitoring

The zoo is always monitored using camera. These monitoring datas will be also given to the tourists, so that they can easily find out where the animal is in the zoo. The real time monitoring data can also be analyzed by the zoo administrator. So by not going in person they can see each animal by sitting in a room. Administrators can make use of this monitoring to look after the sleeping time of animals. They can also look after whether the animals eat their food as they are also an important part of predicting their health using AI.

E. Prediction of health using AI

We can predict the health status of animal using AI. The datas from the biomedical sensors and the feeding results can be used to analyze the data using deep learning. This can be used to predict the health of animals and if anything bad found, administrators can easily contact the doctor.

F. Finding out the exact animal from its group.

We know that in zoos some animals will be appearing in groups. So from it we need to differentiate which animal is not eating the food or is having bad health by using RFID.

G. Website

A website will be provided with all the relevant information that can be used by both the tourists and officials in the zoo. They can give details regarding the animals and administrators can enter the health status of the animals daily in the website. This can be used by other higher officials. Maps can be enter into the website. This can be used by the tourists to easily find out the location of each animal.

III. METHODOLOGY

The overall architecture can be implanted using these techniques:

A. Beacon

The technology of Beacon [8-9] uses a low energy Bluetooth 4.0. It is inexpensive but small physical device. This device can be arranged in various parts of the zoo mainly to achieve message transmission to nearest animal. It can be used for the management of animal activity status from the signals and health monitoring. It can also be used for micro-positioning to quickly find animals while they are lost. As Beacon is used, the administrators can easily manage it from mobile devices. Moreover the tourists can also get information of the nearest animals.

B. Arduino

Arduino is simple actuator device which can be used for building digital devices[10]. It can interact with environment to sense and control objects in the physical world. Arduino can be used here as the transmission control device to control the transmission of the signals.

C. Artificial Intelligence(AI)

This project proposes to analyze the health of animal through the deep learning architecture. The sensory signals will collect and these data can be used to process the deep learning architecture [11]. From this result we will obtain the

health status of animals. We can use deep learning to weak artificial intelligence to know the state of animal [11, 12, 13]

D. Cloud Computing

In order to allow animal administrators to use different platforms and devices and AI to integrate these massive data results, cloud computing in cloud database has to use [14, 15]. The benefits of using the cloud platform are:

1) The zoo can flexibly customize the website and adjust the service to suit their needs. Moreover the administrators can access the cloud service from anywhere through the internet connection.

2) Zoos can speed up its development without worrying about infrastructure costs or maintenance.

3) Developers of the intelligent animal care and management system can focus on application development and regularly update analytical methods to provide the most accurate animal care and management functions for the zoo.

IV. RESULT AND DISCUSSION

As these methods combined together, we can completely digitalize the zoo and can help the administrators in their workload. The major impact of this will be in the veterinary area as the prediction of animal health status is an important regarding that. Considering the work of animal administrators, the most tiresome work is feeding the animal. We can automate this by using a relay mechanism. Then they need to report the health status of the animal daily to higher officials. As they need to wait a whole day to report it to higher officials. When the website is developed they can easily report it by not waiting it for the whole day.

The tourists are also an integral part of the zoo. Zoo is usually very large and will always take time to cover the whole area. When a facility in which the tourist can easily find out the location of the animal it can be resolved. As for that we will provide the map of zoo in the website. So these are the main output that we can find out after the process.

V. CONCLUSION

The automation of zoo is an area where many developments didn't take place. If an aid to the zoo administrators is find out it will be new innovation on its part. Moreover the technologies are still not invaded the field of zoo, we need to think of something new on it. Thus it is always helpful to the zoo administrator if something technically aid them. So we are making many techniques that can help them by automate feeding and having a website for them to report their daily activity. They can just sit in their room and can monitor the activities of animals.

We know that it is very difficult to find out the disease of animals. Here we use deep learning techniques to predict the health status of animals. So that we can predict whether the animal is healthy or not. There is another technique that is used to feed the animal. This will lead to another aid for the administrator. Moreover we consider the tourists by giving them the details of animals in the zoo and the location of each animal.

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